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Secretary, Federal Communications Commission
Washington, DC 20554
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We have reviewed the following documents relative to the FCC's Notice of Proposed Rule Making proposing to open for commercial development a portion of the spectrum above 40 GHz.

Notice of Proposed Rule Making
Comments of the National Aeronautics and Space Administration
Comments of Cellularvision
Comments of Teledesic Corporation

Specifically, we have reviewed comments by NASA, Teledesic and Cellularvision relative to the proposed shift of the Local Multipoint Distribution Service from operation at 27.5 - 29.5 GHz to operation at 40.5 - 42.5 GHz. On the basis of this review, we make the following observations.

1. The acquisition costs of transmitting and receiving equipment for the 41 GHz band will be higher than those for 28 GHz equipment. These costs need not be prohibitively higher since, because of the Government's investment in EHF satellite communications technology, a reasonably mature technological base that can support production of 41 GHz components is already in place. In addition, as Teledesic noted, the RF components comprise a small part of the system. Baseband signal processing and interface equipment costs are not affected by a change in operating band.

2. Both NASA and Teledesic maintain that propagation losses at 28 GHz are similar to those at 41 GHz. This is true if clear air losses are the subject for comparison. Losses in rain, however, at 41 GHz are nearly twice (in dB) those at 28 GHz. NASA and Teledesic avoid acknowledging this by postulating somewhat reduced availability at 41 GHz. The reduction in availability is not large, i.e., 0.1 to 0.2 percent. Their computations, as well as Cellularvision's, focus on the New York City area to establish high availability. The

southeastern United States, however, lies in a different rain belt where the occurrence of heavy rain is far more likely. Here, the margins required to achieve the 99.9 to 99.75 percent availability discussed in the responses are unrealistic. The achievement of 99.9 percent availability on a 3 mile link would require 33 dB margin at 28 GHz and 54 dB at 41 GHz. 99.6 percent availability is, however achievable with margins of 9 dB and 16 dB respectively. In essence, then, all three respondents have focused on the New York area (the location of Cellularvision's currently installed system) to establish their points. The area that will stress availability, however, is the southeastern United States where availability at either frequency will be less than in New York if three mile links are contemplated. System operators providing service in this area will necessarily have to compromise availability and cell size.

3. Cellularvision's response contains several statements that we question. These are noted below.

    a. We believe that Cellularvision's statements relative to 41 GHz component cost are based on what is currently commercially available in the 41 GHz band, which is precious little. We tend to agree with Teledesic's and NASA's opinions that this reflects the fact that there is currently no market at 41 GHz. As noted above, we feel that the technology exists to support component production in this band and suppliers could readily supply components at reasonable cost.

    b. A transmit tube power of 45 Watts output at 41 GHz is projected as the maximum available. Currently, both Hughes and Siemens are manufacturing 44 GHz TWTAs with power outputs of 250 Watts. The extension of this technology to the somewhat lower frequency of 41 GHz should be trivial.

    c. A reduction of 1 dB in transmit antenna gain is projected as a result of moving to 41 GHz. This results from reducing the antenna's vertical aperture and an expected increase in antenna losses. First, there does not seem to be any

good reason for reducing the antenna aperture. The best antenna radiation pattern for this service should be a $\csc\theta$ one that provides a constant power flux density independent of the distance between the transmitter and receiver. This pattern can be implemented at 41 GHz using the same vertical aperture as used at 28 GHz with a resultant 1.6 dB increase in gain (not 3 dB as indicated by NASA). Second, antenna losses at 41 GHz would be negligible as they would at 28 GHz. Thus, while Cellularvision projects a gain reduction of 1 dB, we would expect a gain increase of 1.6 dB.

d. Cellularvision projects a 3 dB reduction in receive antenna gain due to the lower efficiency of the antenna material and the higher sensitivity of the feed network and design. We see no reason why any of this should be true. The pointing accuracy restraint requires that the antenna beamwidth not change and, hence, its gain. Antenna losses, as indicated above, should be negligible and the feed network should be less sensitive at 41 GHz since it operates over a 4.9 percent band rather than 7.1 percent at 28 GHz.

e. Degradation in sidelobe and polarization performance is cited as contributing to spectral inefficiency. Both of these can be as easily controlled in an antenna design at 28 GHz as at 41 GHz. There does not seem to be any reason that the shift to 41 GHz would result in degradation of these parameters. It might be worth noting that multipath can have a significantly larger effect on polarization performance of the system than antenna effects.

f. Cellularvision attributes an increase in signal attenuation due to foliage of between 3 and 8 dB as a result of the proposed frequency change. Experiments conducted at Lincoln and elsewhere in the early 1980s indicate that attenuation due to foliage, while high (3 - 4 dB per meter), remains substantially constant in the frequency range between 20 and 44 GHz.

g. An increase in receiver noise figure from 6 db to 8 dB is predicted. Current technology permits receiver noise figures of about 4 dB at 44 GHz. This technology, already in place, should certainly be able to furnish 41 GHz receivers with noise figures of 6 dB or less.

In summary, we feel that the effects of the proposed change will lie principally in higher rain attenuation and RF component cost increases. Some of the rain attenuation can be offset by increased transmit antenna gain. RF component cost will be higher but we believe that the higher costs will be incremental.

Sincerely,

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WCC/asn